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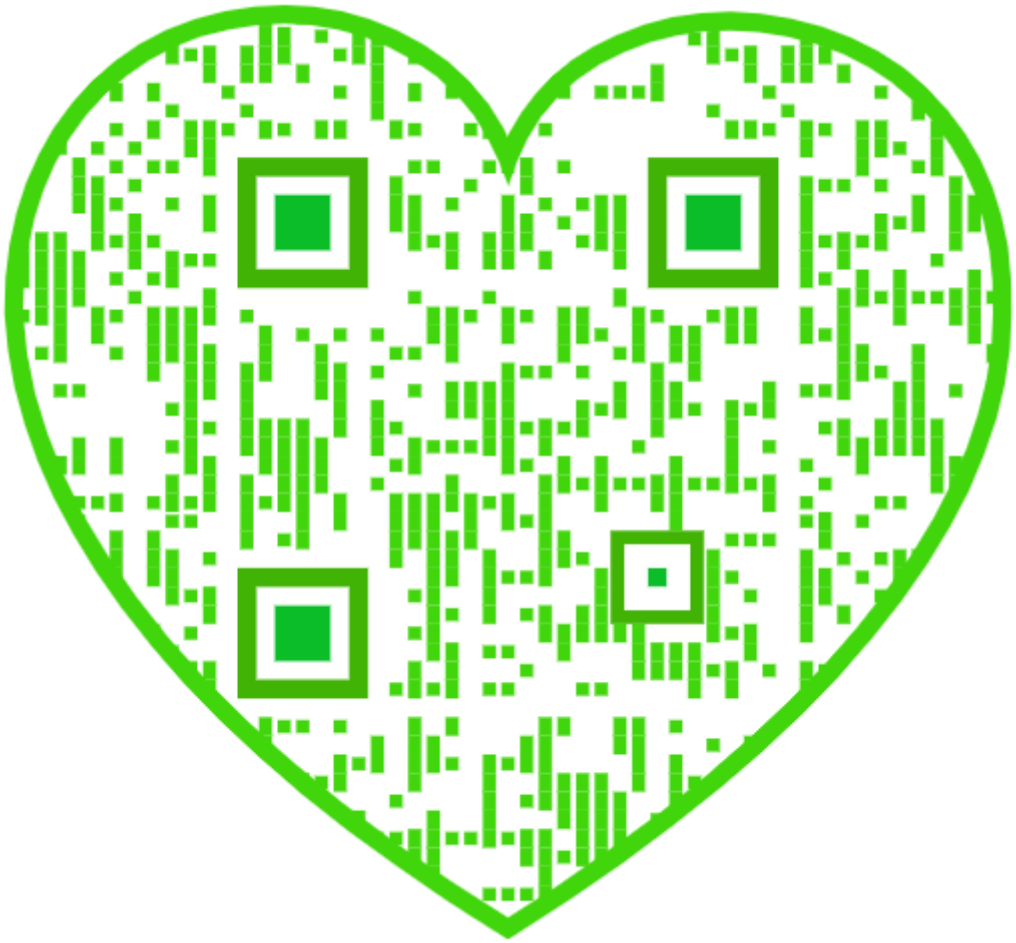

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The Soldiers' Manual of

FOOT CARE & FOOT WEAR

by

Capt Cecil Webb-Johnson

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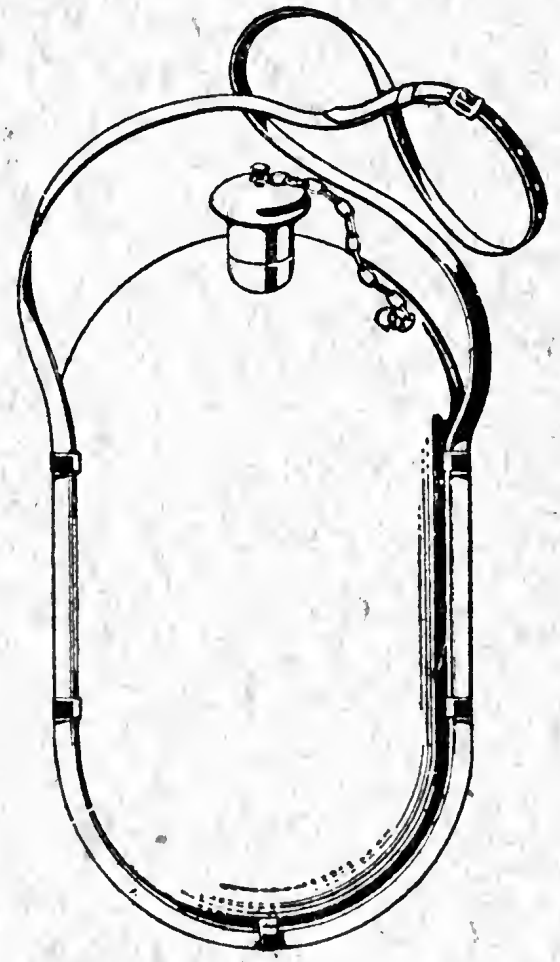

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THE SOLDIERS' MANUAL

OF

FOOT CARE

and

FOOT WEAR

BY

CECIL WEBB-JOHNSON, M.B., Ch.B.

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OF THE BRITISH MEDICAL ASSOCIATION.

Compiled from articles published in the "British Medical Journal" and from lectures delivered in England and elsewhere.

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INTRODUCTION

THIS small book is composed of the articles I wrote for the *British Medical Journal* on the outbreak of war; a paper I read at the Annual Meeting of the British Medical Association in July, 1914, and of lectures given by me on various occasions to the Surrey, Middlesex, and other Regiments, at home and in India. Written originally for doctors dealing with troops, there are many medical words and expressions which may be incomprehensible to the lay reader, but I have not considered it necessary to alter them, as the purely scientific parts may well be omitted by the non-medical public. The subject of the soldiers' feet has never been taken really seriously by any Government prior to this war, and even in 1914 it was common knowledge that a certain nation could not enter the European arena for lack of footgear, and

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we ourselves have had to provide millions of boots for the armies of our Allies. Although Governments have been backward in recognizing the importance of the soldiers' feet and footgear, the same cannot be said of the military leaders of the past. Napoleon said he made war with legs as well as arms. Marshal Niel thought good shoes as important for his infantry as good mounts for his cavalry. Saxe said that military tactics depended upon the feet of his soldiers. Wellington, when asked the most important part of a soldier's equipment, replied, "firstly, a pair of good shoes; secondly, a second pair of good shoes; and thirdly, a pair of half soles." In the war of 1870-71 frost-bite was common amongst the French troops, who had no socks and only bad leather shoes of very inferior quality. It is recorded that they used straw in their boots in place of socks.

A critic of this book wrote:—"The general effect of cold may have lost Napoleon his Moscow Army, but one of the immediate

causes which rendered the units helpless against the Russian guerillas must have been frost-bite of the feet. Whenever there is a rapid advance across hostile territory continued for several days, an advancing army gains impetus by the elation which comes of following a retreating enemy. But if the greatest care is not taken, it will lose its speed and *élan* at an increasing rate by reason of foot trouble. It may even be possible that this factor has effected to some minor extent the failure which followed the three great advances which the Germans have made during the present war." In the present campaign there has been so much trench warfare that, in proportion to other wars, the wear and tear of the soldiers' feet have been less than usual. Still, the fact remains that, according to Botha, our soldiers' feet gained us German South-West Africa, and we could not have accomplished the great retreat at the commencement of the war had our soldiers not been able to stand long and forced marches. Trams, motors

and aircraft will do much to reduce the amount of marching, but in any great war there will always come a time when the feet of the army must be depended upon.

It has often been stated that the German Army is the most powerful and best organised in the world, and the following extract from the German Field Service Regulations is of interest : " By far the most important factor affecting the efficiency of troops for war is their power of marching. In many cases the arrival of troops at the right place, at the right time, and in good fighting trim, may be the decisive factor in the situation."

The Germans insist upon the washing of the feet every day, and hold any man responsible who falls out on the march through any neglect on his part. Recognising that every ounce added to the weight of a man's boot is equal to 100 ounces on his back, they see that the boots are light, and even use aluminium nails. Foot deformities are responsible for a great wastage of fighting material, and in

1882 Léques found that foot troubles accounted for one-third of all cases of exemption from active service amongst young French soldiers. For this reason it is the duty of every country to do its utmost to train boys and young men to wear properly fitting boots, and take care of their feet, and such teaching should naturally come in the course of the series of "Health Lectures" which most schools provide. It is said that "cleanliness is next to godliness," but one finds in practice that with some people it is "next to impossible." Once insist upon the feet being washed and thoroughly dried every day, and the majority of cases of foot soreness will disappear. The other great point I would insist upon is: if the foot does not fit the boot, make the boot fit the foot. Eliminate *foot and boot disease* from the Army, and the efficiency of the forces will be enormously increased.

For trench warfare on the Continent for the winter months, I should like to see the adoption of long boots, and the use of putties.

which are not suitable for wet weather, done away with. When wet, putties are liable to contract, and in addition to being very uncomfortable, are apt to cause or aggravate such disabilities as gangrene, frost-bite, and inflammation of the veins of the feet and legs.

FORT WILLIAM,
Calcutta, July, 1915.

THE SOLDIERS' MANUAL
OF
FOOT CARE
and
FOOT WEAR

THE question of feet comprises in itself a subject of no inconsiderable magnitude. The importance of soldiers having well-formed and normal feet cannot be exaggerated, for an army lasts only as long as the feet of its infantryman. Feet to the soldier are what tyres are to the motor, wings to the bird. In fairy lore, classical literature, and mythology, the means of locomotion given to man and beast have engaged the attention of the greatest writers of the centuries. Children love to hear of the magic boots of the giant whose every stride covered a mile, while the tales of Cinderella and her slipper, and of the children who lived in a shoe, have become immortal. The

people of Abarimon, a district of Scythia, we are told, could only live in their native air, and their feet had toes behind their heels. Mythology tells us that Mercury, the son of Jupiter, had wings to his feet which enabled him to transport himself from place to place with lightning velocity. Amongst his many exploits he is said to have robbed Venus of her girdle, and Mars of his sword; nor must we forget Achilles, who was plunged by his mother in the Styx, and rendered invulnerable except in his heel. His life was one long day of deeds of valour until he met his death at the hands of Paris, who wounded him with an arrow in his vulnerable heel. Like Achilles, armies have proved themselves invulnerable except in their feet, and have suffered the humiliation of seeing victory snatched from their grasp on account of inability to march any further. When once the ambulatory power of a force breaks down, its *moral* and spirit suffer, and its attributes of pertinacity of purpose and celerity of movement are lost. This has been recognised by

all the armies in the field to-day, and every endeavour is being made to cope with the question from a military and a medical standpoint. No one has shown more solicitude for the soldiers' feet than our King, who, when visiting the wounded, made anxious inquiries about their feet and footgear. The letters from soldiers at the front, published in the daily papers, constantly contain complaints about their feet, and may be well summed up in the sentence of Private F. Burton, of the Bedfords, who writes: "Sore feet are the great trouble, most of us being a bit lame." Brave as a man may be, it is a physical impossibility for him to march far with blistered and sore feet, and he becomes a drag on his comrades. In this respect one cannot help calling to mind how Captain Oates walked out of the tent into the Antarctic blizzard, with his poor maimed feet tortured with frostbite, his one thought being to save his comrades, who refused to proceed to "One-ton Camp" until he could accompany them.

No army in the world is better provided

with good serviceable footgear than our own, and the Government, recognising this to be of the utmost importance, are making strenuous efforts to keep this efficiency constant and lasting. The British "Tommy" has a special affection for his boots, for he knows that, in war time, they are his best friends, and a striking example of this is related by Sir Frederick Treves in his book, *The Tale of a Field Hospital,* in which he says: "Amongst other traits, one notices that the soldier clings with great pertinacity to his few possessions, and especially to his boots. There was one poor man at Spearman's who was in great distress because, just as he was being sent down to the base, he had lost his solitary boot. He said it contained a puttie, a tin of jam, two shillings in money, and a bullet that had been taken out of him."

The evolution of the human foot is of great interest. Man is the only animal whose thighs and trunk are in a straight line when standing, for even anthropoid apes have their

lower limbs bent towards the belly at the hips, and flexed at the knees, when walking. To have gained our present erect posture has taken millions of years, for there is no bone, muscle, or organ in the body, which has not changed. Although the ordinary monkey runs on all fours, the gibbon, or small anthropoid ape, runs along the branches of a tree on its legs in an erect posture, only using its long arms to seize overhanging twigs to help it on its way, or to swing from bough to bough, or tree to tree, when pursued or in a hurry. In the gorilla the legs are comparatively stronger, and fashioned to bear the weight of the whole body, and in consequence have lost some of the features which make the monkey's foot chiefly a grasping organ. *Pithecanthropus*, the earliest human-like fossil discovered, had in all probability a foot like our own, for no human foot has ever been seen with the great toe separated like a thumb, as is the case in all anthropoids. To the scientific mind, however, there is little doubt that the great toe

was once set like a thumb, and that the foot was used as a grasping organ. Wire-walkers and the native artisans of the East use the great toe to steady and balance themselves and their work, causing the muscles of this organ to be well developed. The human foot was evolved, as far as one can say, in the Miocene period, and the upright posture of man appeared with the evolution of the gibbons. The chief changes which have taken place in the lower limb are :

(*a*) The straightening of the limb into a line with the trunk when standing.

(*b*) The stiffening of the mid-tarsal joint.

(*c*) The lowering of the heel until it reached the ground when standing or walking.

(*d*) The disappearance of the thumb and the substitution of the great toe.

The two diagrams show roughly the position of the lower limb in the pronograde dog-like monkey and in the anthropoid ape.

In the former the limb is bent towards the belly, and flexed at the knee, while the mid-

tarsal joint is very flexible, and the heel is a long way from the ground; while, in the

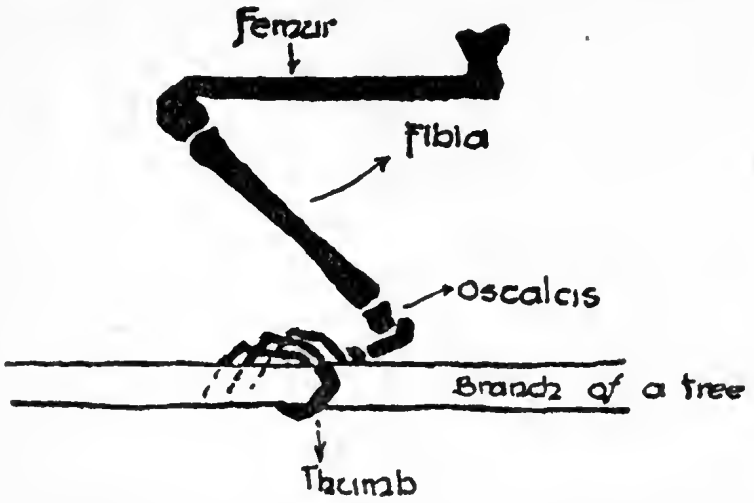


Fig. 1.—Diagram of the foot of pronograde dog-like monkey grasping a branch of a tree. The heel is bent up and does not touch the branch; mid-tarsal joint is flexible.

latter, the limb is getting nearer the straight line, the mid-tarsal joint is becoming less flexible, and the heel is approaching the ground. The human foot, having to bear the whole weight of the body, is provided by nature with natural arches, which are recognized by engineers to be the strongest in existence. The hollow bony arches of the foot give the necessary strength and elasticity, and, in addition, protect delicate structures (blood vessels and nerves) from pressure and injury.

In man, the arch of the foot was evolved by :

(*a*) Development of a tonic and tetanic condition of the muscles of the toe and the flexors.

(*b*) The stiffening of the mid-tarsal joint.

(*c*) The approximation of the metatarsals 2, 3, 4, 5, to metatarsal 1, and not the opposite, as is usually supposed.

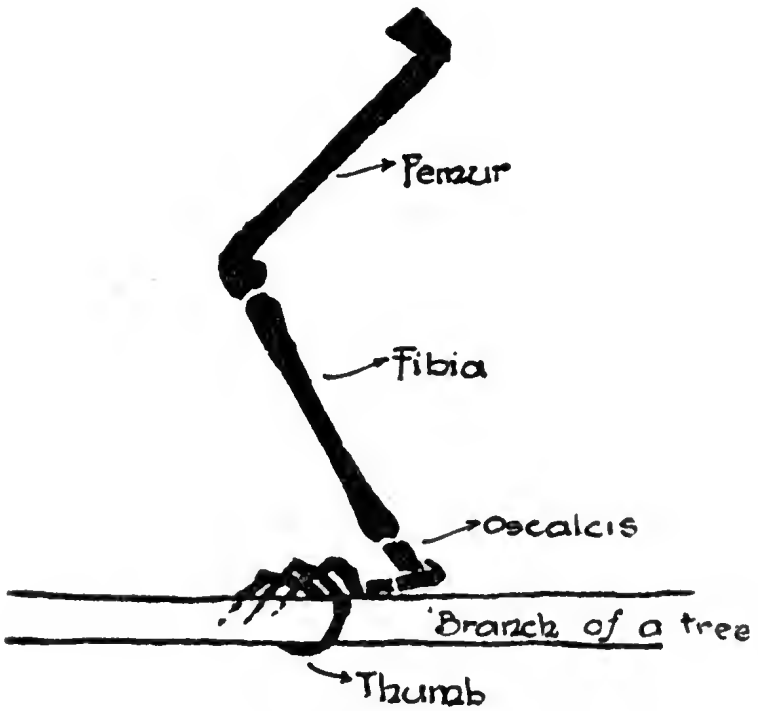


Fig. 2.—Diagram of the foot of an anthropoid ape. The heel is not bent so much, and nearly touches the branch ; mid-tarsal joint is less flexible.

From within outwards, the longitudinal arch is dependent upon :

(*a*) The way in which the bones are fitted together to form an arch.

(*b*) The way in which the bones are held together by ligaments, especially the inferior calcaneo-scaphoid ligament, supporting the head of the astragalus.

(*c*) The tendons running round the inner ankle inverting the foot and flexing the toe, all tending to strengthen and maintain the arch, especially the tibialis posticus.

(*d*) The small muscles of the foot.

(*e*) The plantar fascia and the skin.

In walking or standing the maintenance of the arch depends on muscular action. If, from strain or overwork, the muscles or tendons lose their power of bracing up the arches of the foot, and this task is left to the ligaments, which may themselves give way, either rapidly by rupturing or gradually by

stretching, the result is what is known as "flat-foot." It follows from this that the weight of the body should be distributed so as to cause least burden on the muscles of the arch, and should fall just in front of the transverse arch.

The skin of the sole of the foot is composed of three layers, the most superficial

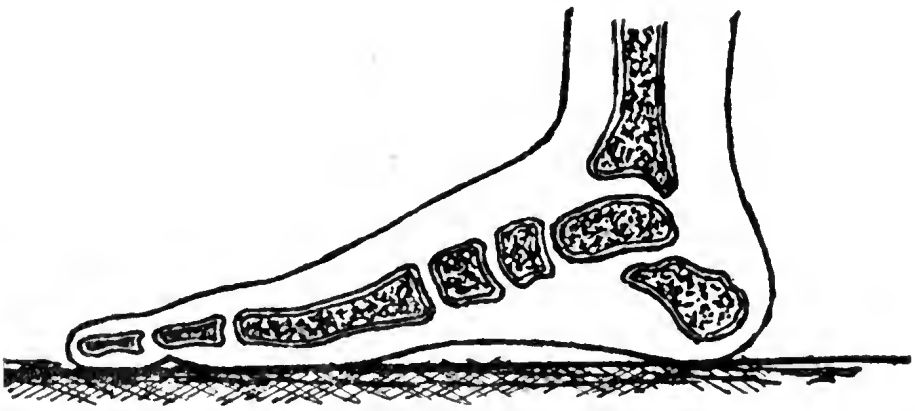


Fig. 3.—Diagram of section of a foot lengthways, showing bones of longitudinal arch.

of which varies in thickness and hardness according to the amount of friction and pressure it is subjected to. The middle or mucous layer is intimately connected with the other two layers, and, although it contains no blood vessels, it may allow fluid from those in the deeper layer to pass through it.

This exuded fluid, not being able to pass the hard horny layer, separates the first and second layers, and forms a blister. The third layer, or true skin, is composed of dense elastic tissue containing blood vessels, nerve endings, sweat glands, &c., and this is the layer which is affected when men complain of sore feet.

Having briefly touched on the morphology,

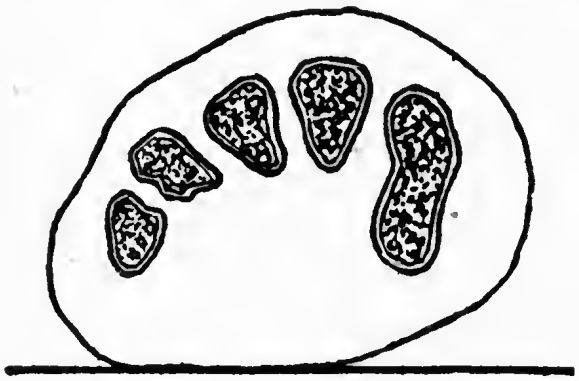


Fig. 4.—Section of a foot crossways, showing bones of transverse arch.

anatomy, and physiology of the human foot, we must next consider how it is protected from injury by artificial means. The custom of wearing something to cover and protect the foot is of great antiquity, and in the British Museum there are specimens of Egyptian shoes and sandals dating back

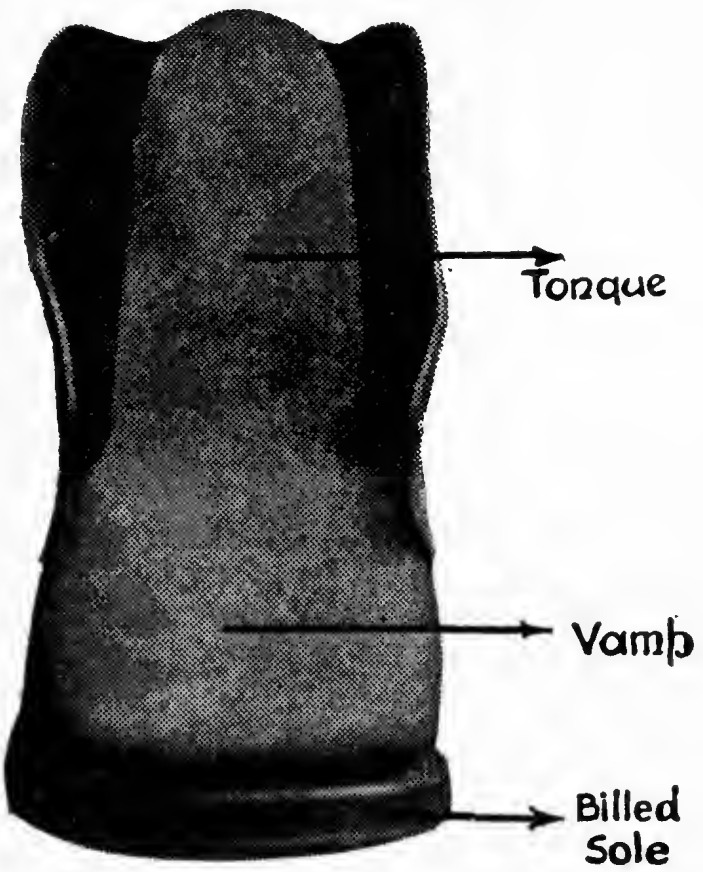
some three thousand years. Sandals of plaited papyrus and other materials were used by the ancient Egyptians, Greeks, and Romans, and are worn to this day in the East. They persisted, in Europe, until the fourteenth and fifteenth centuries, when the *poulaines* became the fashion. On account of their length, which sometimes reached several feet, the *poulaines* were found inconvenient, and gave way about the end of the fifteenth century to the *souliers camus*. In turn the narrow and broad shoes came, and were followed by various forms of boots, the chief fault of which was that there was little or no difference in the two feet. Gradually the patten, which was used for outdoor wear, was superseded by the heel, and each foot was properly fitted with its own boot. The sandal, being correctly shaped to the normal foot, with a straight inner edge, caused little deformity, and the two straps, the latchet and the forestrap, which kept it in position, helped to maintain the proper adducted position of the great toe in walking

and standing. Ancient writers, about the time of Christ, in spite of this, have left on record descriptions of deformities caused by ill-fitting sandals and shoes. In Europe, when the sandal was discarded in favour of the shoe, the tendency amongst the fashionable set was to have it smart and pointed, though in the reign of Henry VIII it was considered more fashionable to have shoes wide and broad.

We must next review the steps taken by the Government to provide soldiers with suitable footgear. On joining the Regular Army each soldier is given two pairs of Army boots and three pairs of socks, free. They are kept in stock sizes, and it is the duty of the officer to make quite sure that the correct sizes are issued, for if the soldiers are allowed to choose their own boots without official supervision, they are apt to let "vanity override wisdom," and choose too narrow or too small a boot. This is known in the Army as "fitting the eye instead of the foot," and even after the proper size boots have been

issued, the soldier will often have them altered in shape at his own expense to make them look smarter. This should never be allowed, and, if discovered, should be severely dealt with. It may happen that no stock size will fit, in which case a man is permitted to have his boots specially made for him. The fact must not, however, be overlooked that such a man may prove a menace to his unit in a long campaign, for when his boots are worn out he will find it extremely difficult, or impossible, to get another pair to fit him. In every battalion there is a shoemaker's shop, where the boots are repaired at a fixed rate. The Army socks are made of grey worsted, and are of regulation sizes. It is the duty of the soldier to see that they are kept clean and in proper repair. Periodically a kit inspection is held, when it is decided whether the boots and socks are in satisfactory condition. If the company officer is not satisfied that such be the case, he either orders them to be repaired or new ones purchased. Every soldier has

a clothing allowance, out of which new kit is purchased. If, at the end of a certain period there is a surplus, the money is added to his regular pay, but if there is a deficit it is subtracted. By this means every soldier is



encouraged to be careful and economical. If he is careless and extravagant, he has to pay for such weaknesses out of his own pocket.

When the British Army is mobilized, every soldier should possess two pairs of boots and

two pairs of socks. If these are not in good condition, the Government supply new boots in place of those not considered fit for active service. On reaching a foreign country, in order not to hamper the soldier when marching, his kit-bag containing his spare kit is left in charge of the company storeman at the Infantry Base Depot. Amongst the other articles in this spare kit are one pair of boots and one pair of worsted socks, which can be forwarded from the base when it is considered convenient or necessary. On active service the British soldier does not carry a spare pair of boots with him, but fifty pairs of shoes and thirty pairs of ankle boots or Highland shoes for each infantry battalion are carried in the regimental transport. There should always be supplies at the base for replacements. The Territorial in peace is not supplied with either boots or socks by the Government, so that the oddest assortments of both are often seen. The County Associations, however, usually make a grant to men who are in possession of suitable boots

for the annual camp, and on embodiment every Territorial is given 10s. by the Government if his kit is considered satisfactory by his company officer. It would make for more uniformity and efficiency if the Government could see its way to provide both boots and socks free of cost to every Territorial on embodiment. Every reserve man has his mobilization equipment, including his boots and socks, kept ready for him at the mobilization stores.

The German recruit is given one pair of Wellingtons (*lange stiefel*) and one pair of canvas shoes (*Schnürschuhe*).

The Wellingtons are of black calf skin, into which the trousers can be tucked, and are hobnailed. There is no issue of socks, and each man must provide his own, so that many, to save expense, use square foot cloths (*Füsslappen*) to wrap their feet in, and they are often greased or oiled. In the German Army, although the footgear is so inferior, the question of sore feet is not as large as might be expected, because of the

constant supervision of the feet. Dusting powders and formalin are constantly used on the march, while the daily washing of the feet is compulsory, and there is severe punishment for the soldier falling out on the march on account of sore feet, if his company officer consider it in any way due to neglect. Every company has a boot-maker, whose duty it is to repair the boots and keep them in order. In the American Army each recruit is supplied with five pairs of boots and one pair of barrack shoes in his first year. Unlike the British Army boots, the American ones are supplied with "box toe caps," and the men say that they are not only very comfortable, but that they do not cause blisters, as the cap is lifted from the toes, while the British "toe" is apt to cling to them. The boot is made to fit well up round the ankle and so prevent "rubbed heel." Every American recruit is given fourteen pairs of stockings, eight pairs cotton, and six pairs woollen. The woollen socks are kept solely for marching, and the cotton ones for

garrison duties. To ensure having always a clean pair of socks on the march, four pairs of woollen socks are taken, one pair being worn, another pair being carried on the man in his personal kit, while the other two pairs are in the surplus kit.

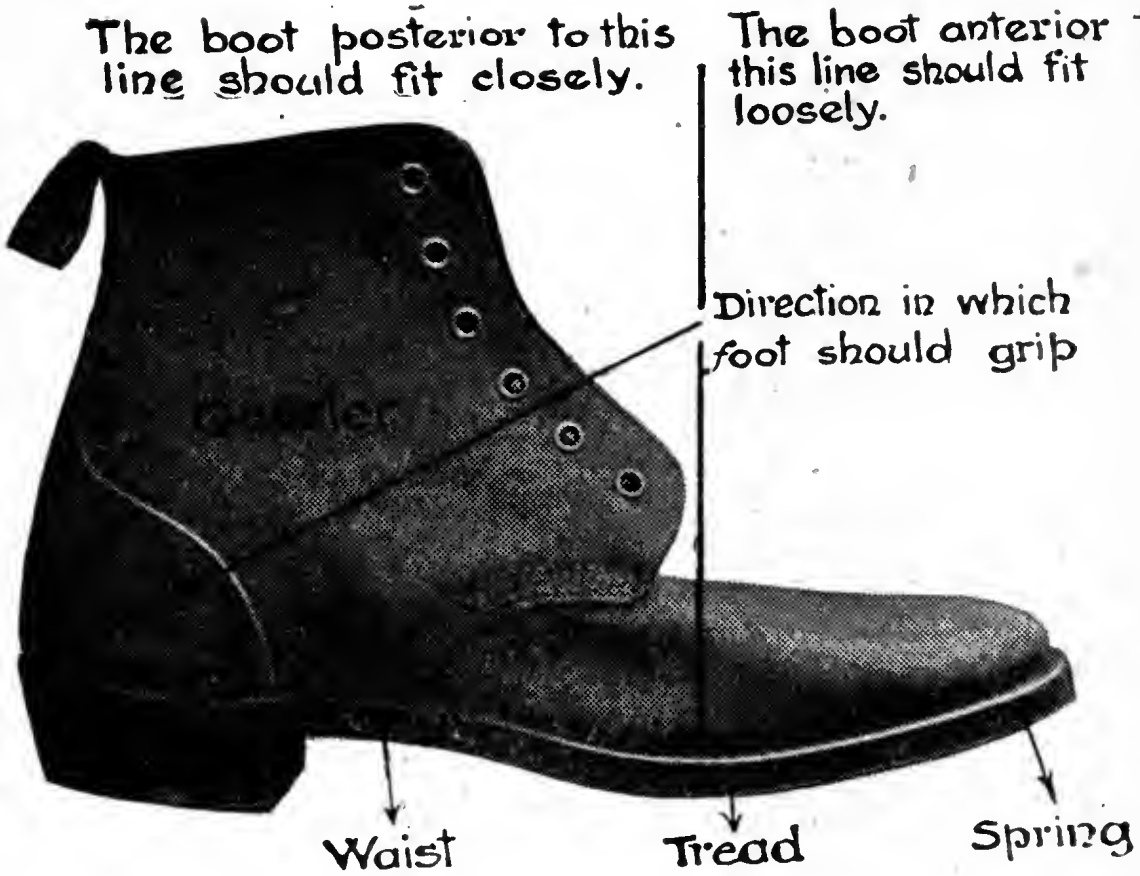
The Army Boot.

Photographs of the Army boot are given in three positions. Made of stout leather, it consists of the following parts :—

The Sole is composed of two stout layers of leather sewn together, with or without a central filling. To add to its durability, and to prevent slipping on wet ground, nails are inserted into it, and the sole is said to be "billed." The danger of hob-nails is that they may fall out and leave holes, through which water may gain entry into the inside of the boot.

The Waist being the narrowest part of the sole, is apt to "give" too much, and for this reason a piece of stout leather is usually inserted between the two layers, from the heel to the tread.

The Heel consists of stout leather, and is "whole-tipped" in order to prevent it wearing out too quickly, and to act as a protection from stones and other objects when marching. Generally speaking, the lower the heel


The boot posterior to this line should fit closely.
The boot anterior to this line should fit loosely.
Direction in which foot should grip
Quarter
Waist
Tread
Spring

the better, for if too high, it tends to throw the weight of the body on to the toes and strain the arch of the foot and the ligaments of the ankle, especially when marching downhill.

The Vamp, or front portion of the boot, is made of a softer leather, and is rounded over the toes. It covers the toes and instep, and

is continued up in front of the ankle into the *tongue,* which reaches well to the top of the boot.

The Quarter, or back part of the boot, covers the ankle-joint and the heel, and is pliant over the former and stiff over the latter. It is composed of two halves seamed together, with the edges of the seams turned outwards. It is stitched to the vamp in front and the "*counter*" behind, and is pierced with eyelet-holes for lacing. The laces are made of strong leather. On no account should hooks for facilitating lacing be allowed.

Fitting the Boot.

It may seem a matter of small importance to insist that the boots fit the feet properly, but it must not be forgotten that ill-fitting boots are the cause of bunions, corns, hallux valgus, metatarsalgia, ingrowing toenails, hammer toes, bromidrosis, and hyperidrosis.

The fitting of ready-made boots is no easy matter, and many things have to be considered before the right pair is finally selected. Not only the length and breadth of the foot, but also the height of the instep,

must be taken into account, and for this reason *magnitude* as well as *size* must be allowed for. The size and magnitude are stamped on the inside of the boot for future reference, the former being placed below the latter—for example $\frac{7}{2}$.

When standing or walking, the whole weight of the body is thrown on the feet, and two changes then take place, namely : (*a*) The whole foot spreads out and increases in length and breadth. (*b*) The great toe is drawn to the middle line of the body, although its alignment is seldom that of the first metatarsal bone, as it should be. For these reasons it is necessary to make the soldier stand and walk in the boots to see if they are comfortable and roomy enough in front. It is important to remember that the foot swells when heated and fatigued, and that a boot which fits perfectly over a thin sock, may be very uncomfortable over a thick one.

An ideal boot should protect the foot from cold, wet, and external injury, and support

it without hindering any of its normal movements or causing any undue pressure upon any part. It should fit tightly round the heel and as far forward as the middle of the metatarsus, but should be roomy in front of this to allow for the spread of the foot, the adduction of the great toe, and the free use of the metatarso-phalangeal joints. The sole of the boot should have a good projecting welt, be straight on the inner edge, and be pliant, so as to ease the toes and the tread when marching. If the front part of the sole is not pliant, it bends up and forms a curve called the "*spring*" of the boot, and gets fixed in this position. Although some soldiers say that such a boot facilitates marching by enabling them to use their feet simply as rockers, with minimum muscular effort, sooner or later troubles will arise, such as corns in the sole of the feet, with pain and inflammation around the metatarso-phalangeal joints. The vamp of the boot should be pliable, especially near the roots of the toes, so as to allow free movement to

the "natural hinge" of the foot, and should be boxed up and rounded over the toes to prevent pressure or friction. The quarters should not interfere with the bending of the ankle, nor should they quite meet in front, otherwise it will be impossible to lace them so as to apply firm pressure. If the quarters are too high, the soldier will be tempted to leave one or two of the upper holes of the lacing undone to give more movement to the ankle.

I would insist upon the following details being carried out in fitting a soldier with boots :—

1. Fit the boot *after* a march, when the foot is fatigued and swollen.
2. Fit the boot over the thickest sock.
3. Have both boots properly laced, to see that the quarters are not too high and that the ankle-joint is free.
4. Fit both feet.
5. Make the soldier stand and walk in his boots before deciding which pair to give him.

6. If no ready-made pair fit, insist upon a special pair being made.

7. Give full instructions about the preparation and subsequent care of the boots.

8. Give a boot that is too large rather than one that is too small, for leather, when wet, shrinks.

On handing a recruit a new pair of boots, he should be told to soften them *before* wearing them, and this is best done by well soaking them, inside and outside, with crude castor oil. It is important to keep the uppers supple by the constant use of oil or dubbin, and especially is this necessary when the boot is thoroughly wet. If this is not done regularly, the leather becomes hard and brittle, and one of the commonest mistakes a soldier makes is to place his wet boots near a fire. It is on record that during the first winter in the Crimean War our soldiers suffered from their boots getting soaked through, and many were in the trenches without either boots or socks, as the leather of

the boots shrank so much from the constant wetting that, once they were taken off, it was impossible to get them on again.

In the Balkan War, the result of the men being in wet trenches for twelve to twenty-four hours on end was seen in various forms. Many suffered from cholera and dysentery, but it is also stated that gangrene of the foot was not an uncommon occurrence, beginning in a painless way with mere discoloured blistering over one or two toes to death *en masse* of the leg as high as the knee (Max Page). Depage considers that many of these cases were caused by the pressure of damp boots and putties shrinking as they dried. It is probable that a vasomotor disturbance very similar to this occurred in the Crimean War, and was classified in the statistics as frost-bite.

It is true that, *Cucullus non facit monachum,* but the boot *may* make the soldier, and no trouble can be considered too great which not only provides him with a sound and perfectly fitting boot, but also with the

knowledge of how to keep it supple and in an efficient state for the hardships of war.

The Army Socks.

The question of the soldier's socks, although not so important as his boots, is one which requires most careful attention. Some years ago the Germans did away with socks, and kept the soldiers' feet well greased. It was reported to have been successful, not only from the point of view of economy, but it was maintained that the men marched more easily, and that the feet showed fewer blisters than when socks were worn. That this plan had its disadvantages is proved by the fact that the Germans are provided with socks at the present time. The socks should be properly shrunk before being worn, and should be a little on the large size. If too small, they will cramp the foot and compress the toes, and be liable to wear into holes very quickly. If too large, they are liable to cause blisters and sore feet from wrinkling. Unshrunken socks should be at

least two or three sizes larger than the foot, otherwise, after several washings, the heels will be pulled down under the soles, and cause trouble. The Army socks are made of grey absorbent worsted, and must be kept clean, or they become hard and non-absorbent, and cause sore and offensive feet. Each soldier should be taught to darn his socks evenly, so as to leave neither ridges nor imperfections, and on no account should he be permitted to wear socks with undarned holes. As thousands of socks are being made by patriotic ladies all over the country at the present time, the following particulars may be useful :—

The socks are made with heels and toes of the usual kind, and should be woven or hand-knitted with No. 13 needles, and 4-ply super-fingering or wheeling in grey, Lovat's mixture, or natural colour. The lengths of foot asked for are 10 in., 10½ in., 11 in., and 11½ in. ; the largest number required are those measuring 10½ in. and 11 in. in length. For sizes 1 and 2, 64 stitches should be cast on in the first instance, and for sizes 2 and 3, 68 stitches.

A substitute has been tried for socks in the shape of foot-cloths (*Füsslappen*), which can

be more easily washed and dried, as they are simply wrapped round the feet. It is a matter of small consequence if they shrink, but, even with these advantages, good, well-fitting woollen socks have proved to be more efficacious. Socks should not be washed too often, but should be carefully dried and cleaned by shaking and rubbing.

The Soldiers' Feet.

The soldier's foot has not only to support the whole weight of the body, but also to act as a buffer, and prevent shocks being transmitted to the knee and hip joints when jumping or doubling over rough ground. The Germans found that lifting the foot high when marching made the troops more sure-footed, and that while, before its adoption, 25 per cent. of the men stumbled, and 10 per cent. fell in a charge over rough ground, the new method practically eliminated such misfortunes. Any horseman will recognize this, for not only is it safer to canter than to trot on rough ground, but a horse that does not

lift its feet is a danger anywhere, not only to himself, but to the rider.

The soldier's foot must be capable of standing the strain of long marches without becoming incapacitated by pain and loss of power. The medical officer should reject as unfit any recruit who suffers from the following conditions in a bad form :

1. Flat-foot.
2. Hallux valgus.
3. Hammer toe.
4. Ingrowing toenail.
5. Corns.
6. Bunions.

Some of these conditions can be cured so as to give a man a serviceable foot, but with others it is quite impossible. In the former case a recruit should not be accepted *until* he has undergone treatment, and been cured, while, in the latter, he should be unconditionally rejected.

1. *Flat-foot*, if of a slight degree, may be disregarded, as in many cases it does not get worse with long marching. Some

medical officers refuse all cases of flat-foot, but in my opinion this is too drastic. I know a well-known Quartermaster, rejected twenty-nine years ago by the 17th Lancers on account of a slight degree of flat-foot, who was accepted next day by the Grenadier Guards, and who assures me that he has

Fig. 5.—Hallux valgus showing bunion and deformity ; A, bunion.

never had any trouble with his feet from that day to this. In a great number of cases the healthy outdoor life of a soldier, coupled with the physical exercises and marches, tones up the muscles which support the arch. Flat-foot causes the rejection of 11.6 per

thousand men examined, and shows the following signs :—

(1) A person with flat-foot usually walks with his knees bent, and assumes the attitude of a man pushing a wheel-barrow. He rests on the inside of the sole, thus preventing the proper action of the ankle joint.

(2) When the foot is placed on the ground, the sole projects so much on the inside that the finger cannot be introduced beneath it.

(3) The inner side of the foot is flat, or even convex, instead of being concave.

(4) The foot is narrower near the toes than in the neighbourhood of the ankle.

(5) The back of the foot is not sufficiently arched, and a hollow exists below the outer ankle.

(6) The inner ankle is very prominent, and is placed lower than the normal.

In the French Army, flat-foot (*pied plat*) must be very severe to cause the rejection of a recruit, and the simple effacement of the arch (*voûte*) is not considered sufficient to cause incapacity. The formation and maintenance of the arches were fully discussed earlier in this paper; when the muscles and ligaments have yielded, the head of the astragalus and scaphoid may even rest upon the ground, on standing. The flat-footed person walks with the toes turned out, and the heels do not leave the ground, so that all elasticity in walking disappears. In a bad case a man complains of pain along the inner side of the foot and in the calf on marching, and gets tired very quickly. I make it a rule to reject a man with flat-foot if he is quite unable to raise himself on his toes and restore the arch by the action of the muscles of the calf. If the flat-foot is only slight, tip-toe exercises, combined with massage of the deep muscles of the calf and sole of the foot, improve the condition. Mechanical supports are not to be encouraged in the

soldier, though they may be of use in civil life.* I am of opinion that careful lacing of the boots, so as not to retard too much the increasing convexity of the tarsus in the act of rising when walking, considerably helps matters, and a good plan is to tell the men to knot their laces low down (as for a shoe), and then to continue to lace less tightly in the upper holes. The heel and sole of the boot may be made continuous on the inner side, or the inner border may be raised so as to throw the foot on to its outer border.

2. *Hallux valgus*, if in an advanced state, incapacitates a man for marching, for the great toe is pushed either above or below the second toe, thus crowding the other toes together and making them liable to cross.

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* This statement must be qualified considerably now the war has been in progress so long. There is little doubt that such companies as the Scholl Manufacturing Company have done a great deal, by supplying suitable supports, to increase the number of serviceable recruits. The dangers of these supports in the Army are, naturally, their loss or breakage by accident, and the subsequent difficulty of replacement.

The head of the first metatarsal bone is pressed upon by the boot, and gives rise to a bunion.

It is not within the province of this paper to discuss the operative treatment of this deformity, but one may unhesitatingly say that a man with such a foot should be

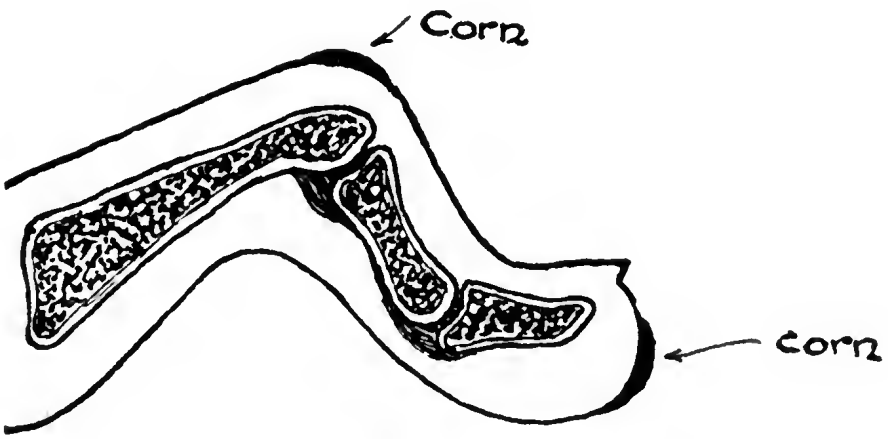

Fig. 6.—Hammer toe, showing deformity and favourite situation of corns.

rejected. Slight cases may be treated by giving a boot with wide toes and a straight inner border, and by keeping the great toe in a straight line by mechanical means.

3. *Hammer Toe.*—In this condition the toe is flexed at the proximal phalangeal joint, on the top of which there is generally a corn. At the end of the toe, where it

presses on the boot, another corn is often found, and these corns become exquisitely painful, and prevent a man from marching.

Formerly the toe was amputated, but to-day the proximal phalangeal joint is excised or the toe straightened by section of the flexed tendon and the lateral ligaments at the first interphalangeal joint. If either of these treatments be adopted successfully there is no need to reject a man, but if operative treatment be refused, he should be found unfit for service.

4. *Ingrowing Toenail.*—This is an extremely painful condition, caused by wearing boots with narrow toes. In a slight case, the boots having been corrected, the nail should be cut square and a wedge-shaped piece taken from the centre, or the centre of the nail should be scraped and filed down, and the pressure relieved by packing plugs of cotton-wool under the free ends and sides of the nail. If this does not relieve the symptoms, the nail should be removed by one of the recognized methods.

5. *Corns.*—Hard corns, caused by the pressure of tight boots, are most commonly found on the sides of the toes, under the tread, and on the heel. Soft corns, caused by dirt and sweat, are usually found between the toes. Corns are more painful in wet than in dry weather, and are said to "shoot," a condition due to a sudden increase of activity in the vascular and sensitive papillæ on the approach of damp weather. The treatment of corns may be divided into palliative and radical, but it should be remembered that if the boots fit properly without undue pressure, the soldier should be free from them. If no chiropodist is at hand, the corns may be rubbed down daily with pumice stone, and if tender, protected with a piece of stockingette plaster, stretched over the corn with a good margin. For the radical cure, the area of corn is painted with tincture of iodine, and all the thickened epidermis is cleared away with a scalpel, this being facilitated by making the skin tense with the left fingers. Then the concentrated apex or

ridges, which are the actual cause of the pain, are lifted out with a sharp-pointed straight scalpel. Often there is a small adventitious bursa, which should also be removed, and an antiseptic dressing placed in the cavity. Circular plasters are seldom effective, as the portion on the distal side of the corn may press back in walking, and irritate, but it is advisable to pad with a crescent-shaped piece on the posterior aspect of the wound, and cover with a stockingette plaster.

6. *Bunions* are generally associated with hallux valgus, and, if accompanied by synovitis, prevent marching. To alleviate the pain a wedge-shaped felt pad should be worn between the great and second toes at the base, and, in addition, a crescent-shaped adhesive felt pad on the metatarsal aspect, posterior to the joint. This condition is greatly helped by a 1-in. zinc oxide strapping round the shafts of the metatarsal bones, sufficiently tight to hold them a little closer together, as with a bunion there is always

a lateral expansion of these bones. This strapping should be put round slightly diagonally, encircling the foot twice and overlapping, so that the total width is 1½ in. Leslie's zincoplast is the best for this purpose, as it causes no irritation and can be worn for a fortnight without discomfort.

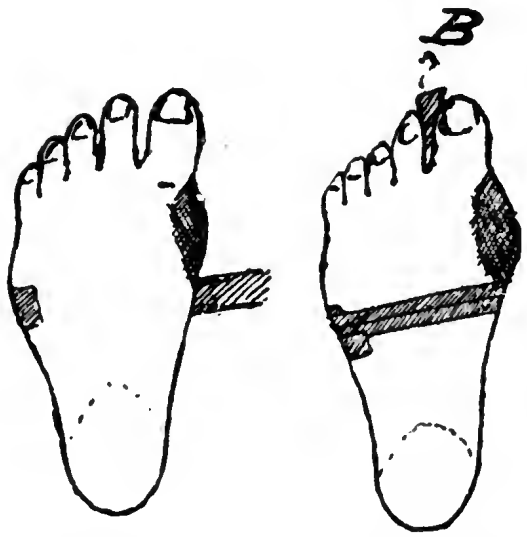

Fig. 7.—B. Wedge-shaped piece of felt; C, bunion.

Incipient bunions may be painted with iodine or rubbed with iodex; if there is much inflammation, the joint can be quickly reduced by an application of antiphlogistine.

7. Foot swelling (*Füssgeschwulst*) is a condition almost always found in soldiers,

and is caused by an abnormal weight being suddenly placed on the middle metatarsal bones. It occurs more frequently in soldiers than civilians because the former are compelled to continue marching when tired, and are not allowed to rest when in this condition. It occurs as the result of either sudden pressure from marching over rough and stony ground when fatigued, or from wearing ill-fitting boots. To prevent its occurrence it should be recognized that the soldier is not a machine, and, whenever it is possible, periodical stops should be ordered on the march.

Sore Feet.

The disabilities of the foot already mentioned, although coming under the general heading of sore feet, as used in military parlance, do not constitute the ordinary variety met with after a march. Sore feet are of several varieties and degrees of severity, and, if promptly and properly treated, may be quickly cured. When the skin of the foot is irritated by the boot or

sock either pressing or rubbing on it, or when, through lack of cleanliness, sweat and various germs collect on it, the foot becomes hot, swollen, and tender. If the condition is not suitably and quickly treated, blisters form, especially under the heel and above it, at the sides of the feet, between the toes,

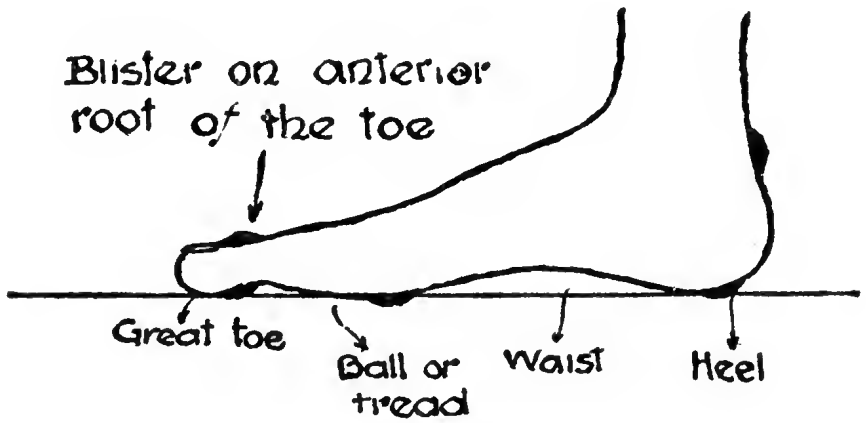

Fig. 8.—Common situation of blisters.

and at the anterior roots of the toes. If this in turn is neglected, there is a danger of the hard, horny skin being rubbed off, and the tender deep layer of the true skin being exposed, and if this is not treated there is every possibility of the deeper tissues being involved, and of an ulcer forming. The

causes of sore and blistered feet after a march are :—

1. *Boots*—
   - (*a*) Too tight, causing pressure.
   - (*b*) Too loose, causing friction.
   - (*c*) Too hard, through lack of oil or dubbin.
   - (*d*) Shrunk, through getting wet.
   - (*e*) Nail or seam inside boot.
   - (*f*) Improperly laced boot.
2. *Socks*—
   - (*a*) Too tight, causing compression of toes, or heel of sock getting under sole of foot.
   - (*b*) Too loose, causing wrinkles.
   - (*c*) Dirty socks.
   - (*d*) Socks with holes.
   - (*e*) Too thin and non-absorbent socks.
   - (*f*) Badly darned socks.
3. *Feet*—
   - (*a*) Dirty feet.
   - (*b*) Sweaty feet.
   - (*c*) Deformed feet.
4. *Accidental*—
   - (*a*) Grit or foreign matter in boot.

(*b*) Burn or scald when cooking.
(*c*) Punctured wound from external object.
(*d*) Weight, such as rifle, falling on foot.
(*e*) Kick or stumble.

5. *Vasomotor*—

(*a*) Frost-bite.
(*b*) Chilblain.

Practically all these causes can be avoided if a little care be exercised and it is seen that :—

(*a*) the boots and socks fit properly ;
(*b*) they are periodically inspected ;
(*c*) the boot is kept soft and supple ;
(*d*) the sock is kept clean and well darned ;
(*e*) the feet are washed and thoroughly dried daily ;
(*f*) there is a regular foot inspection ;
(*g*) the chiropodist is consulted early.

In the paper on "Common Ailments in Camp" which I read in 1914 at the annual meeting of the British Medical Association,*

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* *British Medical Journal*, August 29th, 1914, p. 385.

I said :—" One of the greatest troubles in camp is blistered feet, and a large percentage of men are rendered unfit for duty for one or more days on this account. The men should be taught to see that their feet are washed and thoroughly dried every day after work is over, and if this is found to be impracticable, the feet should be thoroughly wiped with a wet towel, especially between the toes, and then dried. The socks should be greased on the outside with soap, and when they show a tendency to shrink they should be stretched and worn on the opposite feet. I would suggest that a regular foot inspection be conducted by the medical officer in conjunction with the company officers, so that all feet requiring attention can be treated, and at the same time the boots and socks inspected." I have little to add to this, except to put forward a few suggestions as to the best means to adopt to prevent the tender foot from blistering.

Instead of one chiropodist for an infantry battalion or depot, I would suggest that one

be appointed for every company, and that he be carefully trained in his duties. He should regularly inspect the feet of all the men in his Company, and attend to any minor troubles he may discover. He should be directly responsible to the Medical Officer for the feet of his own company, and should be able to instruct men with "fired or blistered" feet how to deal with them. He should be in charge of a few necessary instruments, and also of the various powders, ointments, and lotions used for the various foot troubles he will have to deal with. To encourage good men to take an interest in their work they should receive a little extra pay.

It cannot be denied that some men's feet blister more readily than others, and it is wise in such cases to try to harden the skin and make it less susceptible. When a man's feet are sore and inflamed, but not blistered, it is advisable for him not only to carry out all the rules laid down in this paper, but also regularly to do one of the following :—

(*a*) Rub the feet night and morning with spirit, to which may be added 1 to 2 per cent. of salicylic acid.

(*b*) Paint the tender parts once or twice a day with either a saturated solution of picric acid, or a solution of chromic acid (2 to 3 grains to the ounce).

(*c*) After drying the feet, sprinkle with a powder composed of talc and salicylic acid (salicylic acid 2 grs., talc 1 oz.).

(*d*) Soak the feet in a bucket of cold water to which potassium permanganate, salt, alum, tannic acid, or saltpetre has been added.

In the German Army the following dusting powder is used :—

Salicylic acid	...	...	3 parts.
Starch	...	...	10 ,,
Talc	...	...	87 ,,

In both the French and German Armies the feet are swabbed with a 10 per cent. solution of chromic acid, and this may be repeated in 2—6 weeks' time.

Men who complain of excessive sweating of the feet should soak them daily in a solution of formalin and water (1 to 800), dry them, and dust them with zinc oxide or some other powder. In most battalions about twenty men will suffer severely from this complaint, and they should be frequently inspected by the chiropodist. In bad cases the Germans use a strong solution of formalin, even up to 30 per cent., but I consider this solution too strong. Tender feet may be well greased with zinc or boracic ointment, or the soles of the feet may be soaped. When a man's feet are normally fatigued at the end of a long march, after he has washed and dried them he will find great relief if he lies down and raises the feet by resting them against some firm object.

If, in spite of all these precautions, a blister forms, the fluid should be evacuated aseptically, and the surplus skin, liable to cause pressure, cleared away. An antiseptic ointment should then be applied, and the blister covered with stockingette plaster.

As, after the heel, the most common situation for a blister is the plantar aspects of the fourth and fifth toes, it is in this case advisable to use animal wool round and under the toes to counteract the flexion which causes the pressure on these parts.

In France a strap consisting of good leather was devised to pass round the foot and ankle in a figure of eight over the boot. At one end was a strong buckle, which was adjusted so as to be on the outside of the foot just above the external malleolus, while the other end was pierced with a dozen holes. It was applied sufficiently tight to give support without causing constriction, and acted by more or less fixing the foot in the boot and preventing slipping and rubbing movements, which commonly cause blisters and abrasions. It also acted by minimising the disadvantages of too large or badly fitting boots. It was found as the result of many trials with this strap that it not only prevented blistered and sore feet, but that if such conditions were present it helped men

to march without discomfort who would otherwise have been incapacitated. Further, it was found that the blisters and abrasions healed and dried up, and this was no doubt due to the congestion of the foot caused by the strap (modified Bier). According to all accounts, even men with sprained ankles were able to march with the support of these straps, and although we do not know if the French are using them in this war, it is a simple and cheap contrivance which should at least be given a trial in the British Army.

The commonest cause of *chilblains* is sitting over the fire with wet, cold boots, and these are best treated by restoring the circulation by gentle massage and by wearing warm footgear. Lead and opium plaster may be applied, or the internal administration of tincture of opium may act as a charm in some cases.

Frost-bites, caused by exposure to cold, have given the soldier trouble in the past, and will do so in the future if the circulation is not kept in a vigorous condition and the

foot warmly clad. In treating any case of frost-bite a great amount of patience is necessary to restore the circulation gradually. If the toes are frost-bitten, it is advisable to do this before taking the soldier into a warm place, and on no account should he be brought near a fire until the circulation has been restored. Begin by rubbing the affected part gently with snow, and bathe the feet with water, increasing the temperature gradually until the circulation is fully restored, when the affected parts may be wrapped in cotton-wool or flannel.

Dumarest found that hypodermic injections of oxygen were useful in treating gangrene of the foot, and also in so-called frost-bite in the war, but prevention is better than cure. An excellent way of keeping an active circulation in the feet is to wear a pair of woollen socks, and then, over these, a pair of stockings. This can usually be done if the boots are slightly larger than necessary.

One cannot leave the question of the soldiers' feet without mentioning the fact

that the gonococcus is responsible for many foot disabilities in the army. The *fons et origo* of the trouble should be drastically treated and the serum injections resorted to, but a man with gonococcic arthritis or flat-foot should be rejected, as he will always be a danger to his unit. In no small measure the question of the marching power of a soldier depends upon the medical officer, for not only has he the power of rejecting an unsuitable man, but also he has the responsibility of seeing that the soldier keeps his feet in good order, and ready for efficient service. To do this means constant supervision and advice, and he should remember that there is no *deus ex machina* to remedy the disability immediately it occurs.

Summary.

To make the soldier as perfect a marcher as is consistent with the human foot, I would, in addition to what is being done at present, suggest the following :—

Feet.

(*a*) No recruit with any bad degree of foot deformity should be accepted as medically fit until the condition is cured.

(*b*) Every soldier, on enlistment, should be given a printed pamphlet explaining the importance of foot cleanliness, and he should be periodically lectured on it by an officer.

(*c*) Foot parades should be more thorough and more frequent.

(*d*) The battalion or company chiropodist should be more often and sooner consulted.

(*e*) It should be made *compulsory* for the feet to be washed after every long march.

(*f*) No medical officer should find any difficulty in obtaining adequate supplies of chromic and picric acids, formalin, and dusting powders, or any other drugs he considers necessary.

Boots.

(*a*) The army boot might be improved by allowing more depth over the toes. This could be accomplished by boxing up the anterior part of the vamp and having the end more rounded.

(*b*) Printed instructions and lectures should be given on the best means of keeping the boots in good condition.

(*c*) No man should be allowed to wear new boots until they have been well softened.

(*d*) The proper fitting of a boot should be considered an art, and not a nuisance. Fully one-half of the foot troubles are caused by careless or too rapid fitting.

(*e*) The boot should allow more ventilation of the foot. It is a debatable point which is the worse of the two evils, namely, the possibility of a little water percolating into the boot or the continuous saturation of the foot and sock with stale sweat. In my opinion, a wet foot in free communication with the air is less likely to cause trouble than one which is rendered sodden, soft, and offensive by being bathed in its own sweat, without aëration. To give more ventilation, the tongue of the boot should not be attached to the uppers to the exclusion of all air, and the quarters should be perforated by ventilating holes so as to admit fresh air and allow the

escape of foul emanations and gases arising from the heated and fatigued state of the foot.

Socks.

(*a*) These should be fitted as carefully as the boots.

(*b*) They should be issued *after* having been shrunk.

(*c*) They should be washed after a long march, and different pairs should be worn on alternate days. This should be compulsory.

It may be argued that many of these points are already known to the men, who have been lectured on them by their officers. Even so, it does not follow that they carry out what they are taught and know to be correct, any more than when a man is taught to be good he becomes a saint, or a gouty subject abstains from port because his medical adviser tells him to do so. Further, we must remember that we are discussing the feet not only of the Regular Army, but those of the Territorial Force and

Kitchener's Army. If every soldier were taught to take as much care of his feet, boots, and socks as his rifle, and, in addition, were compelled to do so, sore feet would cease to give trouble. The civil surgeon may inquire, "Why all this toil for the triumph of an hour?" and my answer is, "*Finis coronat opus.*" The crowning hour of success may be gained by men whose feet can carry them to victory, but can never be won by those who cry in despair, *Volo, non valeo.*

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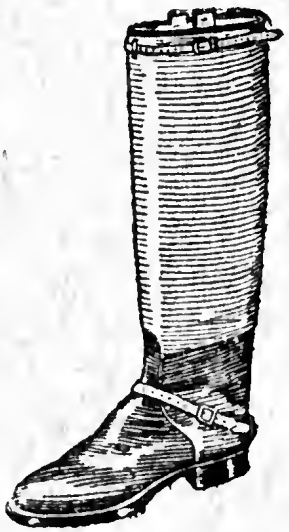

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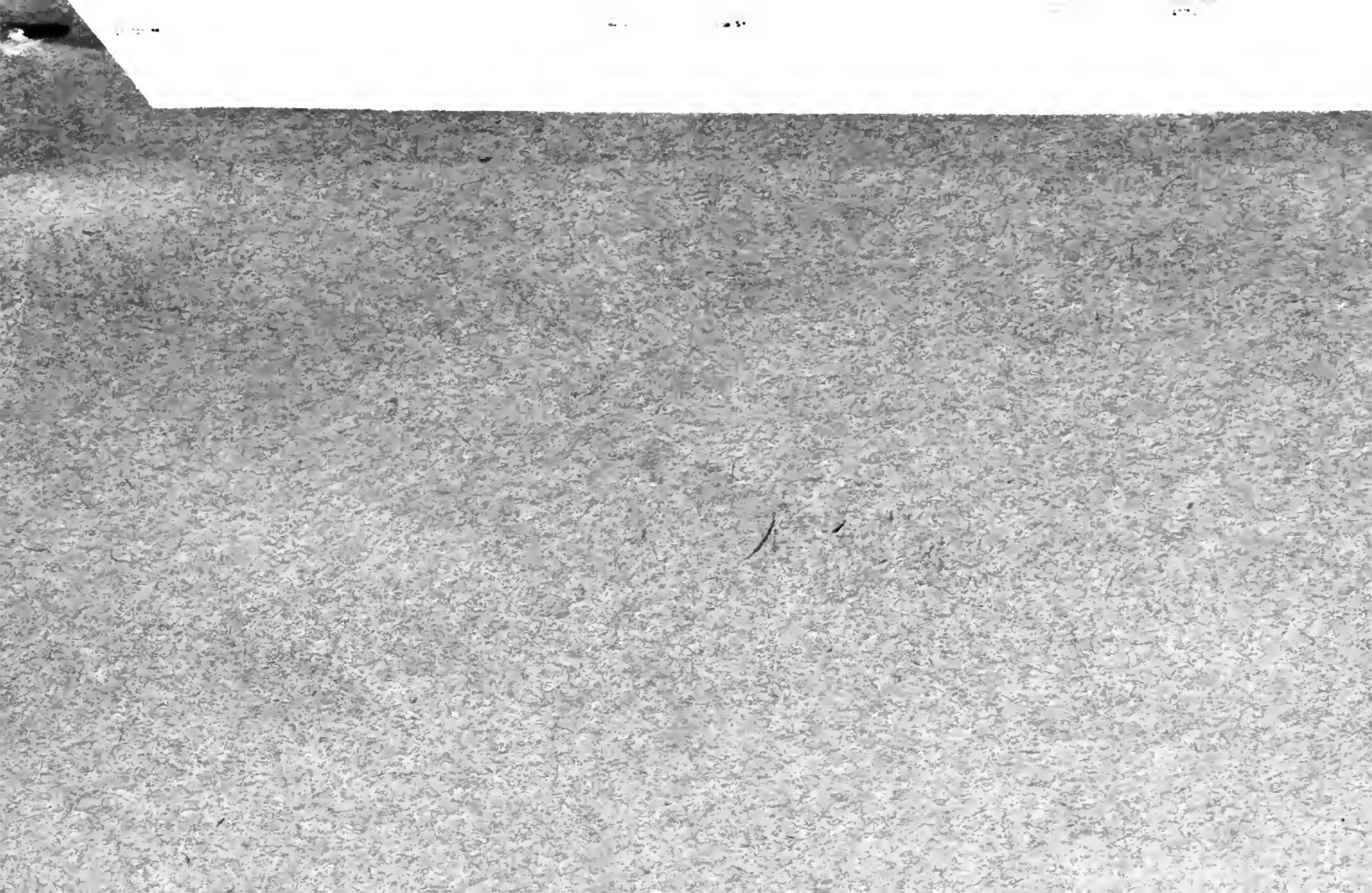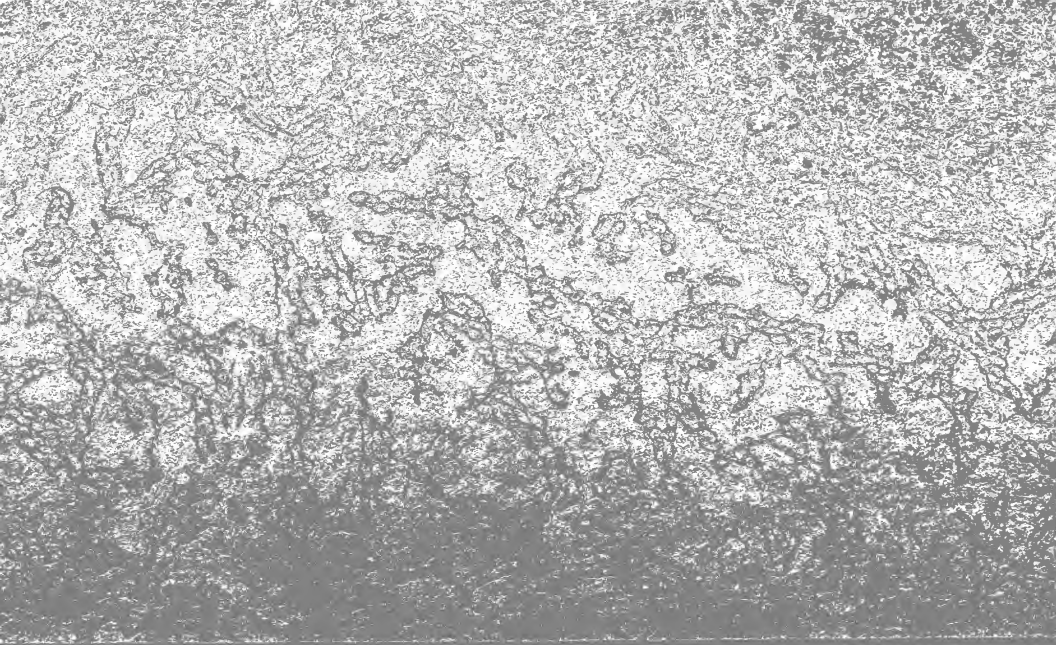
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